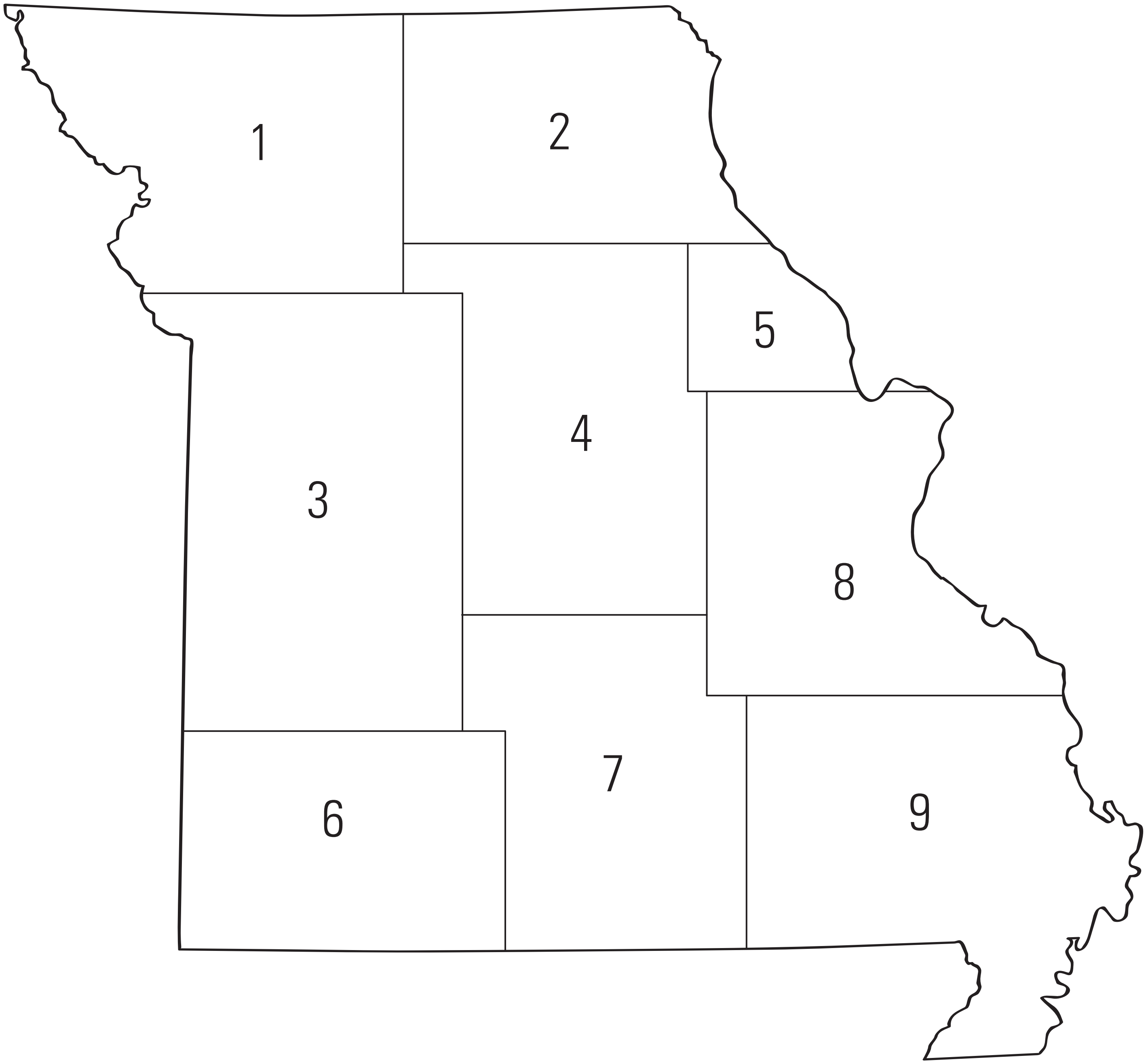
Prepared in cooperation with the Missouri Department of Natural Resources

Quality of Surface Water in Missouri, Water Year 2007

Open-File Report 2009–1096
Revised October 2009

U.S. Department of the Interior
U.S. Geological Survey



Cover picture shows USGS personnel

1. Installing a continous water-quality monitor.
2. Processing indicator bacteria plates.
3. Collecting surface water-quality sample using Equal Width Increment (EWI) method.
4. Measuring streamflow with StreamPro.
5. Servicing a continuous water-quality monitor.
6. Measuring streamflow with ADCP.
7. Measuring pH of a surface water-quality sample.
8. Collecting a surface water-quality sample for pesticide analysis.
9. Collecting a surface water-quality sample from a bridge using a D-96 sampler.

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By William Otero-Benítez and Jerri V. Davis

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U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Suzette M. Kimball, Acting Director

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Conversion Factors

Multiply	By	To obtain
	Length	
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
liter (L)	0.2642	gallon (gal)
cubic meter (m^3)	264.2	gallon (gal)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8×°C)+32$$

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Quality of Surface Water in Missouri, Water Year 2007

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Abstract

The U.S. Geological Survey, in cooperation with the Missouri Department of Natural Resources, designed and operates a series of monitoring stations on streams throughout Missouri known as the Ambient Water-Quality Monitoring Network. During the 2007 water year (October 1, 2006 through September 30, 2007), data were collected at 67 stations including two U.S. Geological Survey National Stream Quality Accounting Network stations and one spring sampled in cooperation with the U.S. Forest Service. Dissolved oxygen, specific conductance, water temperature, suspended solids, suspended sediment, fecal coliform bacteria, dissolved nitrate plus nitrite, total phosphorus, dissolved and total recoverable lead and zinc, and selected pesticide data summaries are presented for 64 of these stations, which primarily have been classified in groups corresponding to the physiography of the State, main land use, or unique station types. In addition, a summary of hydrologic conditions in the State during water year 2007 is presented.

Introduction

The U.S. Geological Survey (USGS), in cooperation with the Missouri Department of Natural Resources (MDNR), collects data pertaining to the water resources of Missouri each water year (October 1 to September 30). These data are collected as part of the Missouri Ambient Water-Quality Monitoring Network (AWQMN) and stored and maintained in the USGS National Water Information System (NWIS) database. These data constitute a valuable source of reliable, impartial, and timely information for developing an improved understanding of the water resources of the State. To make this information readily available, these data were published annually from water years 1964 to 2005 (U.S. Geological Survey, 1964-2005). The published data for the 2006 and 2007 water years are now available on the World Wide Web and can be accessed at *http://wdr.water.usgs.gov*.

The MDNR is in charge of the implementation of the Federal Clean Water Act (CWA) in Missouri. Section 305(b) of the CWA requires that each State develop a water-quality monitoring program and periodically report the status of its water quality (U.S. Environmental Protection Agency, 1997). Water-quality status is described in terms of the waters' suitability for various uses, such as drinking water, fishing, swimming, and aquatic life; these uses are formally defined as "designated uses" in State and Federal Regulations. Section 303(d) of the CWA requires that certain waters that do not meet applicable water-quality standards be identified, and Total Maximum Daily Loads (TMDLs) be determined for these waters (U.S. Environmental Protection Agency, 1997).

Missouri has an area of approximately 69,000 square miles (mi^2) and an estimated population of 5.88 million people (U.S. Census Bureau, 2008) with 22,216 miles (mi) of classified streams that support recreation, agriculture, industry, transportation, and public utilities. An estimated 8,541 mi of stream are adversely affected (impaired) by various physical changes or chemical contaminants to the point that at least one of the waterbody uses has been lost (Missouri Department of Natural Resources, 2007).

The purpose of this report is to summarize ambient water-quality data collected cooperatively by the USGS and MDNR for water year 2007. Data on the physical characteristics and water-quality constituents in samples collected at 64 surface-water stations are presented in figures and tables. These 64 stations were classified based on the physiography of the State, main land use, or unique station types.

The Ambient Water-Quality Monitoring Network

The USGS, in cooperation with the MDNR, designed and operates the cooperative AWQMN, which is a series of monitoring stations on streams throughout Missouri. Constituent concentration data from the AWQMN are used to determine statewide water-quality status and trends in order to meet many of the information needs of State agencies involved in water-quality planning and management. The information collected provides support for the design, implementation, and evaluation of preventive and remediation programs.

The objectives of the AWQMN are (1) to obtain information on the quality and quantity of surface water within the State; (2) provide a historical database of water-quality information that can be used by the State planning and management agencies to make informed decisions about cultural impacts on the State's surface waters; and (3) provide for consistent

methodology in data collection, laboratory analysis, and data reporting.

The MDNR and the USGS have maintained a fixed-station AWQMN in Missouri since 1964. During the 2007 water year, the program consisted of 67 stations including two USGS National Stream Quality Accounting Network (NASQAN) stations and one spring sampled in cooperation with the U.S. Forest Service. From these 67 stations, 64 are included in this report (table 1). Of the 64 stations, 2 were sampled 14 times, 28 were sampled 12 times, 1 was sampled 10 times, 29 were sampled 9 times, 3 were sampled 7 times, and 1 was sampled 4 times during the 2007 water year. Sampling frequency is determined by a number of factors that include the drainage basin size, potential effects from cultural activity, history of chemical change, the need for short-term data, and cost. Three stations did not fit in the groups (classes) defined in the study, and it was decided not to include them. The three excluded stations were 05514500 and 06907300 located in the Ozark Plateau border and 07053700 which is Lake Taneycomo at Branson, MO.

The unique 8- to 10-digit number used by the USGS to identify each surface-water station is assigned when a station is first established and is retained for that station almost indefinitely. The system used by the USGS to assign identification numbers to surface-water stations specifies the order as increasing downstream along the mainstems. A station on a tributary that enters between two mainstem stations is listed between them. The complete 8-digit number for each station such as 05587455, includes the 2-digit part number "05" which designates major river systems (05 is the Upper Mississippi River, 06 is the Missouri River, and 07 is the Lower Mississippi River) plus the 6-digit downstream-order number "587455".

Methods used by the USGS for collecting and processing representative water-quality samples are presented in detail in U.S. Geological Survey (variously dated). Onsite measurements of dissolved oxygen (DO), pH, specific conductance, and water temperature were done at each site according to procedures described in Wilde (chapter sections variously dated). Samples were collected and analyzed for fecal indicator bacteria [fecal coliform and *Escherichia coli (E. coli)*] using the membrane filtration procedure described in Myers and others (2007). Methods used by the USGS for collecting and processing representative samples for nutrients, major ion, trace element, suspended solids and sediment, and pesticide analysis are presented in detail in U.S. Geological Survey (2006) and Wilde and others (2004). All chemical analyses were done by the USGS National Water Quality Laboratory (NWQL) in Lakewood, Colorado, according to procedures described in Fishman and Friedman (1989), Fishman (1993), and Zaugg and others (1995).

Laboratory Reporting Conventions

The NWQL uses a method and reporting convention for establishing the minimum concentration above which a quantitative measurement could be made. These reporting conventions are the method reporting level (MRL) and laboratory reporting level (LRL). The method detection level (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the concentration is greater than zero. Reporting levels typically are set higher than the MDL. A long-term method detection limit (LT-MDL) is a detection level obtained by determining the standard deviation of 20 or more MDL spiked-sample measurements conducted over an extended time. The MRL is defined by the NWQL as the smallest measured concentration of a substance that can be reliably measured using a given analytical method. The LRL is computed as twice the LT-MDL. In box and whiskers distributions (boxplots), values reported less than the LRL, MRL, or as "E" (estimated to be below the MRL) were included in each distribution as a value equal to the MRL or LRL.

Data Analysis Methods

The distribution of selected constituent data was graphically displayed using side-by-side boxplots (Helsel and Hirsch, 2002, p. 24–26). The plots show the center of the data (median—the center line of the boxplot), the variation [interquartile range (25th to 75th percentiles)—the box height], the skewness (quartile skew—the relative size of the box halves), the spread (upper and lower adjacent values—vertical lines or whiskers), and the presence or absence of unusual values, or outliers (individual points). If the median equals the 25th and 75th percentiles, the boxplot is represented by a line. Boxplots constructed for sites with censored data (data reported less than some threshold) were modified by making the lower limit of the box equal to the MRL.

Station Classification for Data Analysis

The stations primarily were classified (fig. 1; table 2) in groups (capitalized) corresponding to the physiography of the State (fig. 2), main land use, or unique station types. The physiography groups include the Plains (PLAINS) in the north and west, the Mississippi Alluvial Plain (MIALPL) in the southeast, and between them the Ozark Plateaus. The Ozark Plateaus are further subdivided into two distinct sections based on physiographic location, the Salem Section (OZPLSA) and the Springfield Section (OZPLSP) (Fenneman, 1938). Main land uses include mining (MINING) and urban (URBAN) stations, while the unique station types refer to springs (SPRING) and the stations located on the big rivers [the Mississippi

Table 1. U.S. Geological Survey (USGS) station number and name of the 64 selected Ambient Water-Quality Monitoring Network (AWQMN) stations.

USGS station number	Station name
05495000	Fox River at Wayland
05500000	South Fabius River near Taylor
05587455	Mississippi River below Grafton, Ill.
06817700	Nodaway River near Graham
06818000	Missouri River at St. Joseph
06821190	Platte River at Sharps Station
06896187	Middle Fork Grand River near Grant City
06898100	Thompson River near Mt. Moriah
06898800	Weldon River at Princeton
06899580	No Creek near Dunlap
06899950	Medicine Creek at Harris
06900100	Little Medicine Creek near Harris
06900900	Locust Creek near Unionville
06902000	Grand River near Sumner
06905500	Chariton River near Prairie Hill
06905725	Musselfork near Mystic
06906300	East Fork Little Chariton River near Huntsville
06918070	Osage River above Schell City
06918600	Little Sac River near Walnut Grove
06921070	Pomme de Terre River near Polk
06921582	South Grand River below Freeman
06923700	Niangua River below Bennett Spring
06926510	Osage River below St. Thomas
06928440	Roubidoux Spring at Waynesville
06930450	Big Piney River at Devil’s Elbow
06930800	Gasconade River above Jerome
06934500	Missouri River at Hermann
07014000	Huzzah Creek near Steelville
07014200	Courtois Creek at Berryman
07014500	Meramec River near Sullivan
07016400	Bourbeuse River above Union
07018100	Big River near Richwoods
07019280	Meramec River at Paulina Hills
07021000	Castor River at Zalma
07022000	Mississippi River at Thebes, Ill.

Table 1. U.S. Geological Survey (USGS) station number and name of the 64 selected Ambient Water-Quality Monitoring Network (AWQMN) stations.—Continued

USGS station number	Station name
07036100	St. Francis River near Saco
07037300	Big Creek at Sam A. Baker State Park
07042450	St. Johns Ditch near Henderson Mound
07046250	Little River Ditches near Rives
07050150	Roaring River Spring near Cassville
07052152	Wilson Creek near Brookline
07052250	James River near Boaz
07052345	Finley Creek below Riverdale
07052500	James River at Galena
07052820	Flat Creek below Jenkins
07053810	Bull Creek near Walnut Shade
07053900	Swan Creek near Swan
07054080	Beaver Creek at Bradleyville
07057500	North Fork River near Tecumseh
07057750	Bryant Creek below Evans
07061600	Black River below Annapolis
07066110	Jacks Fork above Two Rivers
07067500	Big Spring near Van Buren
07068000	Current River at Doniphan
07068510	Little Black River below Fairdealing
07071000	Greer Spring at Greer
07071500	Eleven Point River near Bardley
07186480	Center Creek near Smithfield
07186600	Turkey Creek near Joplin
07188653	Big Sugar Creek near Powell
07188838	Little Sugar Creek near Pineville
07188885	Indian Creek near Lanagan
07189000	Elk River near Tiff City
07189100	Buffalo Creek at Tiff City

River (BRMIG, BRMIT) and the Missouri River (BRMOS, BRMOH)].

Some additional variability was observed on account of differences in drainage area and land use within regions; therefore, secondary size and land-use indicators were employed to develop a complete set of classes. The secondary land-use indicator (in lower case) (fig. 1; table 2) provides a subclassification for stations in similar regions with different land uses. The secondary land-use indicators are: watershed indicators (wi), which identify the most downstream stations of a large watershed; forest (fo); and agricultural (ag). Observations and analyses from watershed indicator stations can be interpreted as representative of the general condition of the watershed. In some instances, the agricultural and forest secondary land use were present, hence, the convention was to mention them in predominant order. For example, an agriculture/forest (ag/fo) indicator implies that the main land use of the watershed is agriculture, although a substantial fraction of it is considered forest.

Summary of Hydrologic Conditions

Surface-water streamflow varies seasonally in Missouri and tends to reflect precipitation patterns. During 2007, a series of storms brought flooding, millions of dollars in damages, and loss of life from Texas to Kansas and Missouri in June and July (National Oceanic and Atmospheric Administration, 2008). Using six streamflow gaging stations, selected for their long period of continuous records and location in different physiographic regions, the 2007 water year monthly mean discharges and the long-term median of monthly mean discharges are illustrated (fig. 3) over the State. Of these six stations, three (05495000 Fox River at Wayland, 06934500 Missouri River at Hermann, and 07052500 James River at Galena) (fig. 3) belong to the AWQMN. The additional three stations (06897500 Grand River near Gallatin, 06933500 Gasconade River at Jerome, and 07067000 Current River at Van Buren) (fig. 3) are not part of the AWQMN.

For the 2007 water year, the annual mean precipitation was approximately 1 inch below the long-term (historic) mean statewide (National Oceanic and Atmospheric Administration, 2007). However, some monthly mean discharges were reported substantially above the long-term median of the monthly mean discharges (fig. 3). This tendency was observed mainly at the gaging stations located in the northern part of the State (05495000 Fox River at Wayland and 06897500 Grand River near Gallatin) during the last three quarters of the the 2007 water year.

The gaging stations in the central part of the State (06933500 Gasconade River at Jerome and 06934500 Missouri River at Hermann) showed discharge values (fig. 3) similar to the historic median of monthly mean values with some exceptions during December, January, and the last quarter of the 2007 water year, where monthly mean discharge values were above the historic median of monthly mean discharge values. The gaging station in the southwestern part of the State (07052500 James River at Galena) showed monthly mean values (fig. 3) consistently above the historical median of monthly means with exceptions during the months of March, June, and August of the 2007 water year. In the southeastern part of the State, the gaging station (07067000 Current River at Van Buren) showed monthly mean values consistently above the median of the historic means during the first 5 months of the 2007 water year.

Peak discharges of the 2007 water year were compared to the peak discharges for the period of record at nine selected streamflow gaging stations (table 3). Of these gaging stations, six (05495000 Fox River at Wayland, 06905500 Chariton River near Prairie Hill, 06934500 Missouri River at Hermann, 07022000 Mississippi River at Thebes, Ill., 07057500 North Fork River near Tecumseh, and 07068000 Current River at Doniphan) belong to the AWQMN and three (05587450 Mississippi River at Grafton, Ill., 06933500 Gasconade River at Jerome, and 07019000 Meramec River near Eureka) do not. Because water-quality standards are based on low-flow conditions, the 7-day low flow for the 2007 water year is compared to the 7-day low flow and minimum flow for selected stations in table 4.

Distribution, Concentration, and Detection Frequency of Selected Constituents

Physical properties, densities of fecal coliform bacteria, and concentrations of major chemical constituents, nutrients, and trace elements were determined in samples collected from all AWQMN stations. The analyses presented in this report include the following contituents: DO, specific conductance, water temperature, suspended solids, suspended sediment, fecal coliform bacteria, dissolved nitrite plus nitrate, total phosphorus, and dissolved and total recoverable lead and zinc. In addition, pesticides were collected at seven stations in the AWQMN. The following pesticides were chosen for analysis in this report: 2-Chloro-4-isopropylamino-6-amino-s-triazine (CIAT; a transformation product of atrazine), acetochlor, alachlor, atrazine, metolachlor, metribuzin, molinate, prometon, and simazine. The selection of these constituents was based on: (1) values or concentrations of the selected constituents are characteristic of stream-water quality in the different physiographic areas and occur because of natural causes, and (2) values and concentrations of the selected constituents are above background concentrations, and in some cases, have resulted in the 303(d) listing of the stream as impaired. Boxplots are presented for the different classes (figs. 4–6).

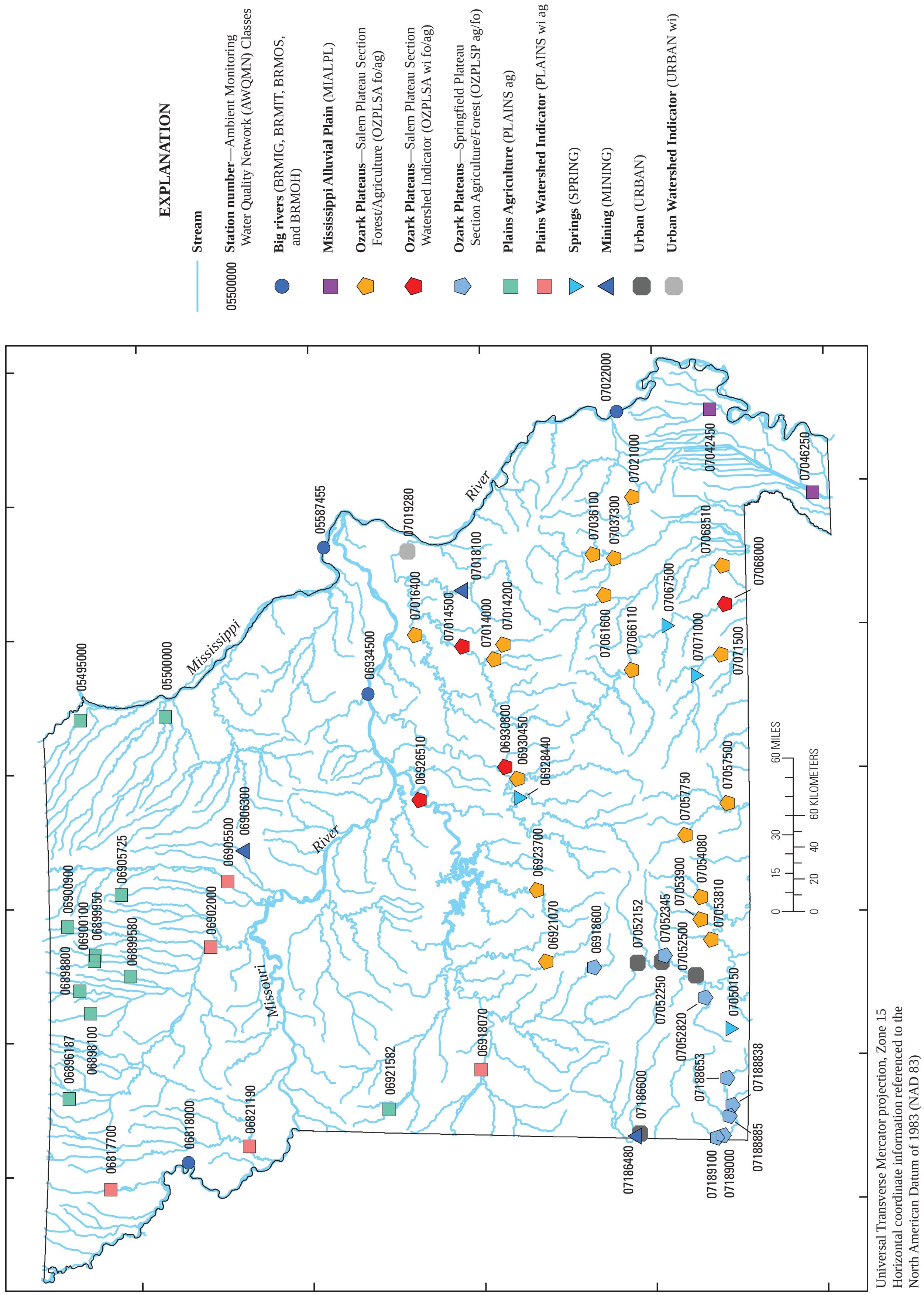

Figure 1. Location and class of selected Ambient Water-Quality Monitoring Network (AWQMN) stations, Missouri, water year 2007.

Table 2. Classification system.

Class (fig. 1)	Description	Number of stations
BRMIG	Big River – Mississipi River at Grafton	1
BRMIT	Big River – Mississipi River at Thebes	1
BRMOS	Big River – Missouri River at St. Joseph	1
BRMOH	Big River – Missouri River at Hermann	1
MIALPL	Mississippi Alluvial Plain	2
OZPLSA fo/ag	Ozark Plateaus – Salem Plateau Section (forest and agriculture)	18
OZPLSA wi fo/ag	Ozark Plateaus – Salem Plateau Section (watershed indicator, forest and agriculture)	4
OZPLSP ag/fo	Ozark Plateaus – Springfield Plateau Section (agriculture and forest)	8
PLAINS ag	Plains (agriculture)	11
PLAINS wi ag	Plains (watershed indicator and agriculture)	5
SPRING	Springs	4
MINING	Mining	3
URBAN	Urban	4
URBAN wi	Urban (watershed indicator)	1

Distribution of Physical Properties and Fecal Coliform Bacteria

The physical properties analyzed for this report were DO, temperature, specific conductance, suspended solids, and suspended sediments. The median DO, in percent saturation, was similar for all station types, ranging from 81 to 101 (fig. 4). Samples from PLAINS ag and URBAN stations had the lowest DO percent saturation values. Median water temperature values also were similar for all station types, ranging from 12.2 to 18.8 degrees Celsius (°C) (fig. 4). The smallest range in water temperature was found at SPRING stations. Median specific conductance values varied substantially among the station types, ranging from 274 to 724 microsiemens per centimeter at 25°C (fig. 4). The largest median specific conductance values were found at the Big River and URBAN stations, with the largest median value at BRMOS. The next largest median specific conductance values were found at MINING and PLAINS ag stations. MIALPL, OZPLSA fo/ag, OZPLSA wi fo/ag, OZPLSP ag/fo, and SPRINGS had the smallest median specific conductance values.

Suspended solids and suspended sediment are measures of the solid material suspended in the water column. These two measures are not considered directly comparable because of differences in collection and analytical techniques. Suspended-sediment concentrations were determined only at the four Big River stations and one station in the OZPLSA fo/ag category; suspended-solids concentrations were determined at all other stations. Median-suspended solids concentrations varied considerably between all station types, ranging from <10 to 159 milligrams per liter (mg/L) (fig. 4). Samples collected at BRMIG, BRMOS, and PLAINS wi ag stations had the largest median suspended-solids concentrations, while samples collected at all OZPL (SA fo/ag, SA wi fo/ag, and SP ag/fo), SPRING, MINING, and URBAN stations had the smallest. Median suspended-sediment concentrations ranged from 132 to 474 mg/L at the four Big River stations, which is substantially larger than the median of 4 mg/L at the one OZPLSA fo/ag station (fig. 4).

Fecal coliform bacteria densities varied considerably between all station types, ranging from 13 to 310 colonies per 100 milliliters (fig. 4). The largest median densities were found in samples collected at BRMOH, PLAINS ag, PLAINS wi ag, and URBAN stations; the smallest median densities were found at OZPLSA wi fo/ag and SPRING stations.

Distribution and Concentration of Dissolved Nitrate plus Nitrite and Total Phosphorus

Filtered and unfiltered samples were collected at all stations for the analysis of nutrients, including dissolved nitrate plus nitrite and total phosphorus. Median dissolved nitrate plus nitrite and total phosphorus concentrations varied considerably between all station types, ranging from 0.22 to 3.64 mg/L nitrate plus nitrite as nitrogen and from <0.04 to 0.42 mg/L total phosphorus as phosphorus (fig. 5). The largest median dissolved nitrate plus nitrite concentrations were found in samples collected at all Big River (BRMIG and BRMIT

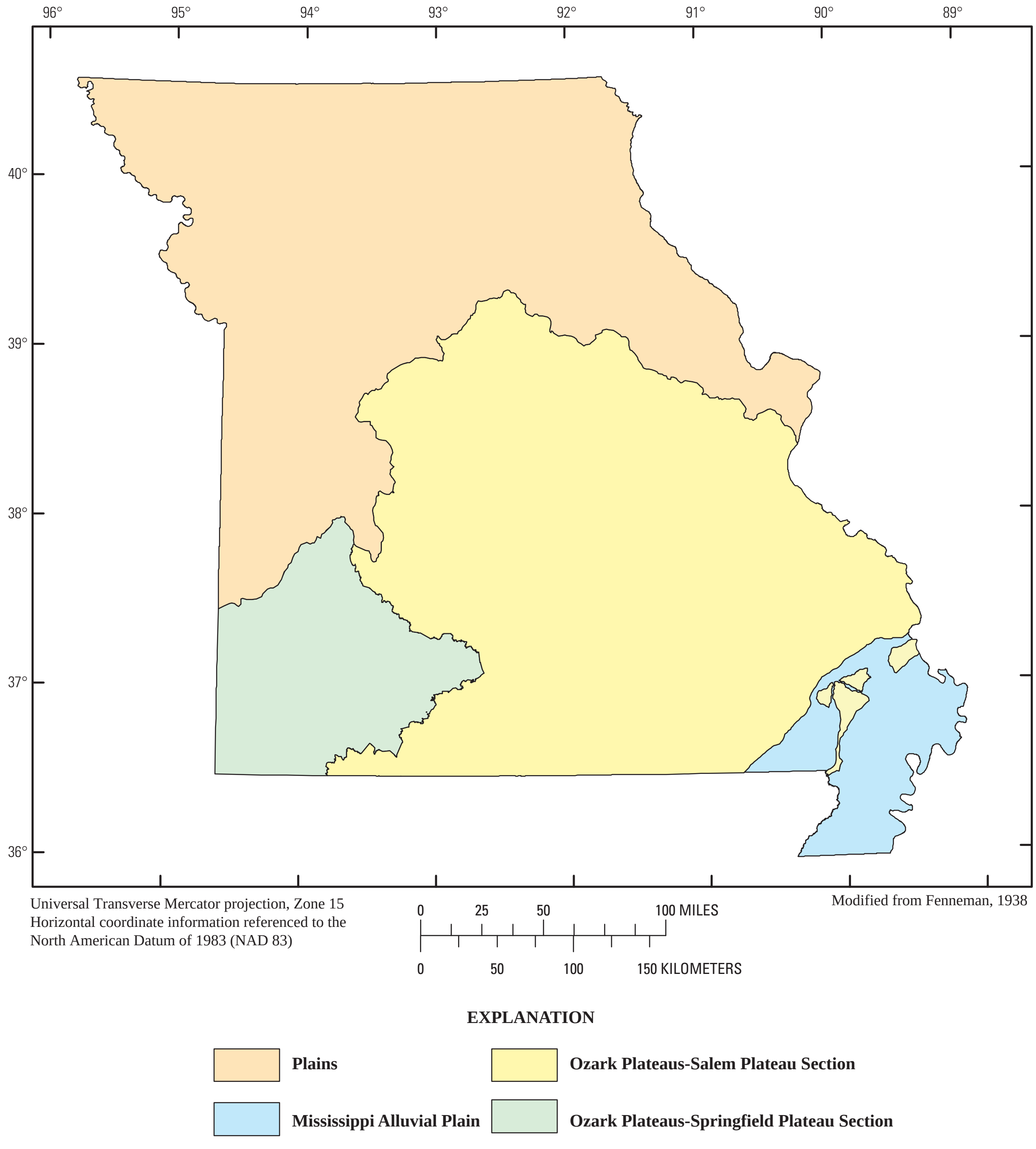

Figure 2. Physiographic regions of Missouri.

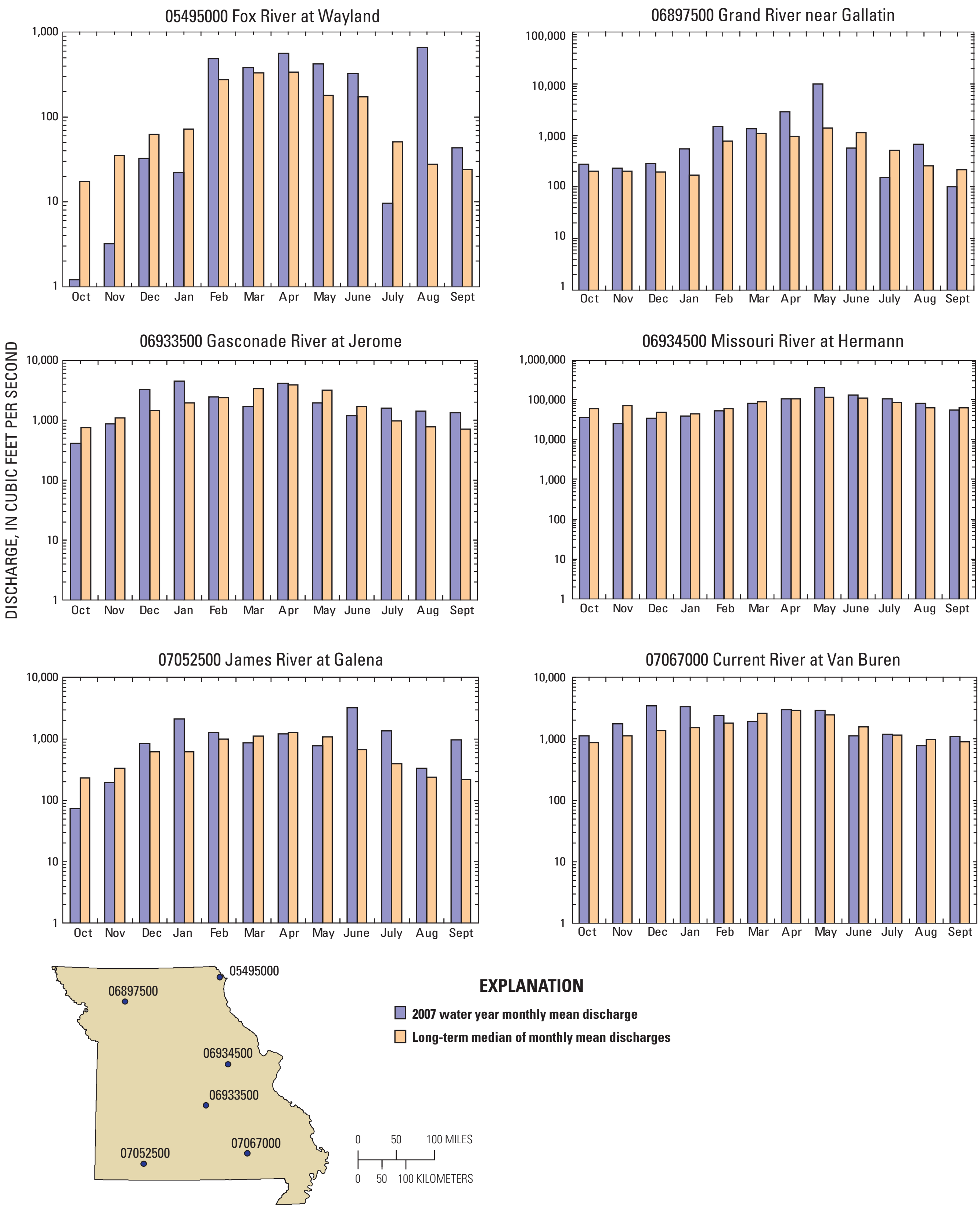

Figure 3. 2007 water-year monthly mean discharge and long-term median of monthly mean discharges at six representative streamflow gaging stations.

Table 3. Peak discharge for the 2007 water year and for period of record for selected stations.

U.S. Geological Survey station number[1]	Station name (period of record in water years)	Peak discharge during 2007 water year		Peak discharge for long-term period of record	
		Cubic feet per second	Date	Cubic feet per second	Date
05495000	Fox River at Wayland (1922–2007)	7,090	February 25	26,400	April 22, 1973
05587450	Mississippi River at Grafton, Illinois (1928–2007)	269,000	April 15	598,000	August 1, 1993
06905500	Chariton River near Prairie Hill (1929–2007)	25,000	May 7	37,100	May 13, 2002
06933500	Gasconade River at Jerome (1923–2007)	15,400	August 22	136,000	December 5, 1982
06934500	Missouri River at Hermann (1898–2007)	301,000	May 12	750,000	July 31, 1993
07019000	Meramec River near Eureka (1922–2007)	29,900	January 16	145,000	December 6, 1982
07022000	Mississippi River at Thebes, Illinois (1933–2007)	491,000	May 13	996,000	August 7, 1993
07057500	North Fork River near Tecumseh (1945–2007)	17,000	December 1	133,000	November 19, 1985
07068000	Current River at Doniphan (1919–2007)	30,600	December 2	122,000	December 3, 1982

[1] Stations 05587450, 06933500, and 07019000 do not belong to the Ambient Water-Quality Monitoring Network.

Table 4. Comparison of 2007 water year 7-day low flow and 7-day low flow for the period of record for selected stations.

[flows in cubit feet per second]

U.S. Geological Survey station number[1]	Station name (period of record in water years)	7-day low flows		Minimum flows for period of record	
		2007	Period of record	Discharge	Date
05495000	Fox River at Wayland (1922–2007)	0.14	0	0	Several years
06820500	Platte River near Agency (1933–2007)	78	0	0	Several years
06921070	Pomme de Terre river near Polk (1969–2007)	1.3	.34	.3	August 10, 1980
07016500	Bourbeuse River near Union (1921–2007)	30	13	11	October 10, 1956
07067000	Current River at Van Buren (1912–2007)	648	479	473	October 7, 1956
07187000	Shoal Creek above Joplin (1942–2007)	55	16	12	September 7, 1954

[1] Stations 06820500, 07016500, 07067000 and 07187000 do not belong to the Ambient Water-Quality Monitoring Network.

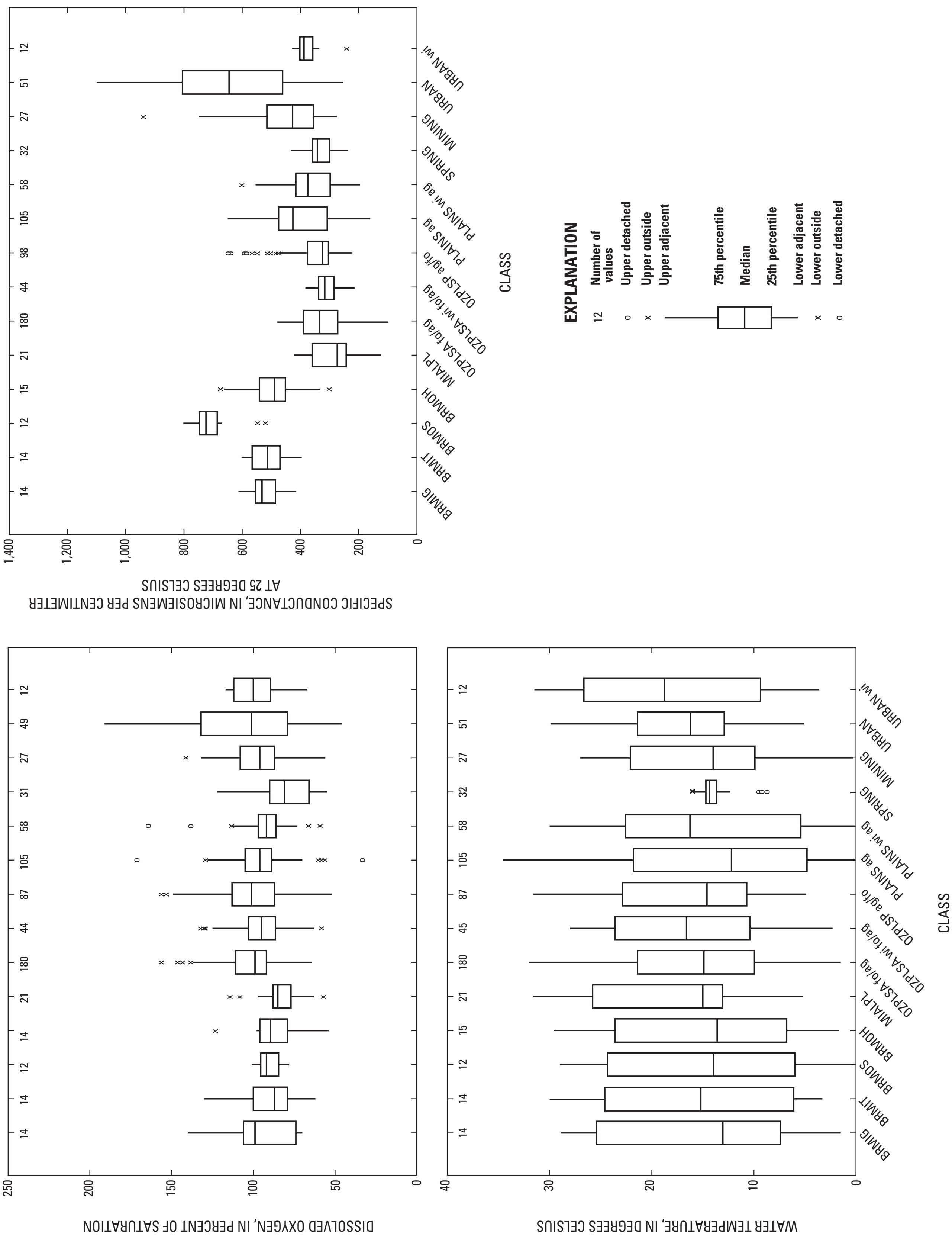

Figure 4. Distribution of physical properties and fecal coliform bacteria indicator densities in samples from 64 stations in the Ambient Water-Quality Monitoring Network (AWQMN), water year 2007.

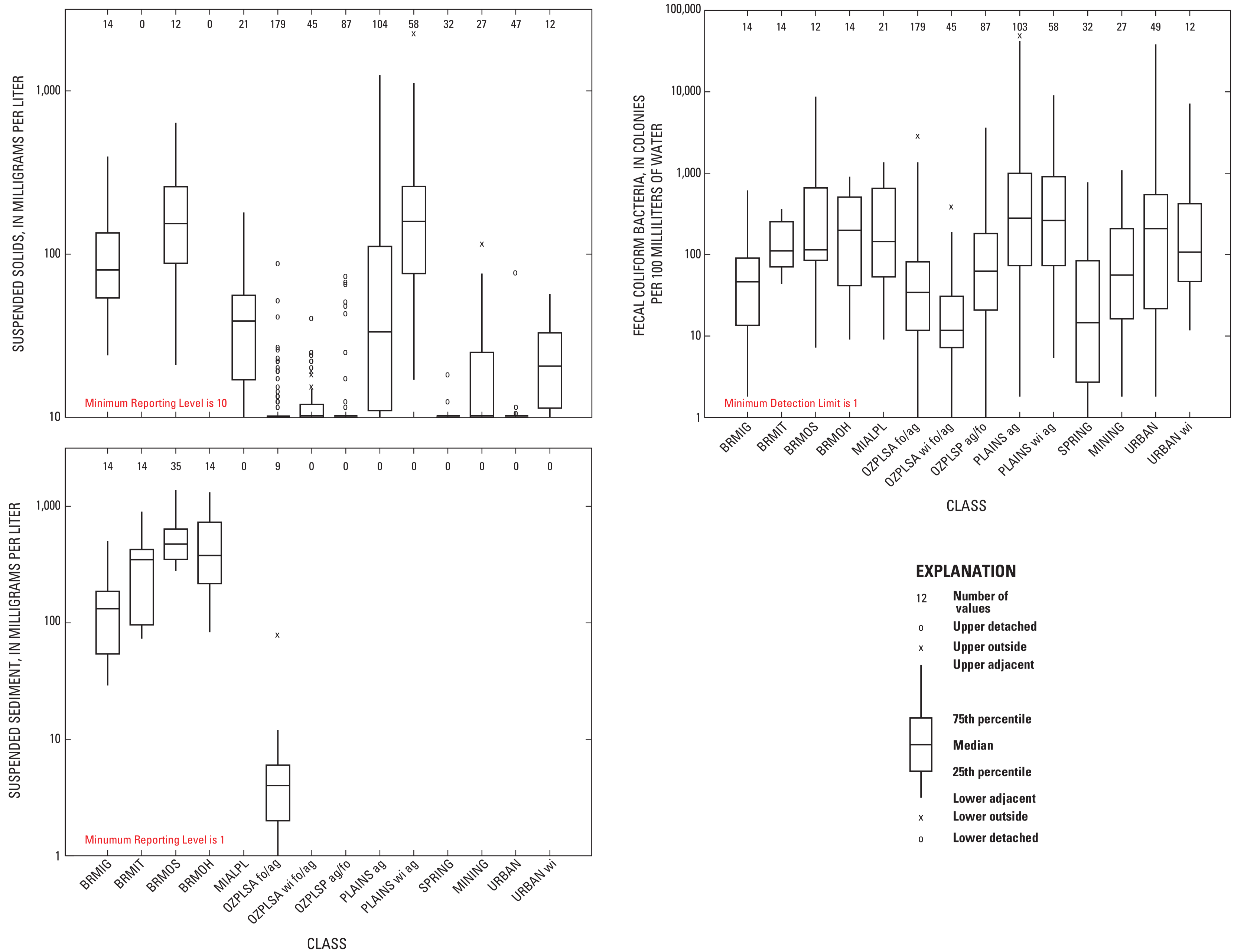

Figure 4. Distribution of physical properties and fecal coliform bacteria indicator densities in samples from 64 stations in the Ambient Water-Quality Monitoring Network (AWQMN), water year 2007.—Continued

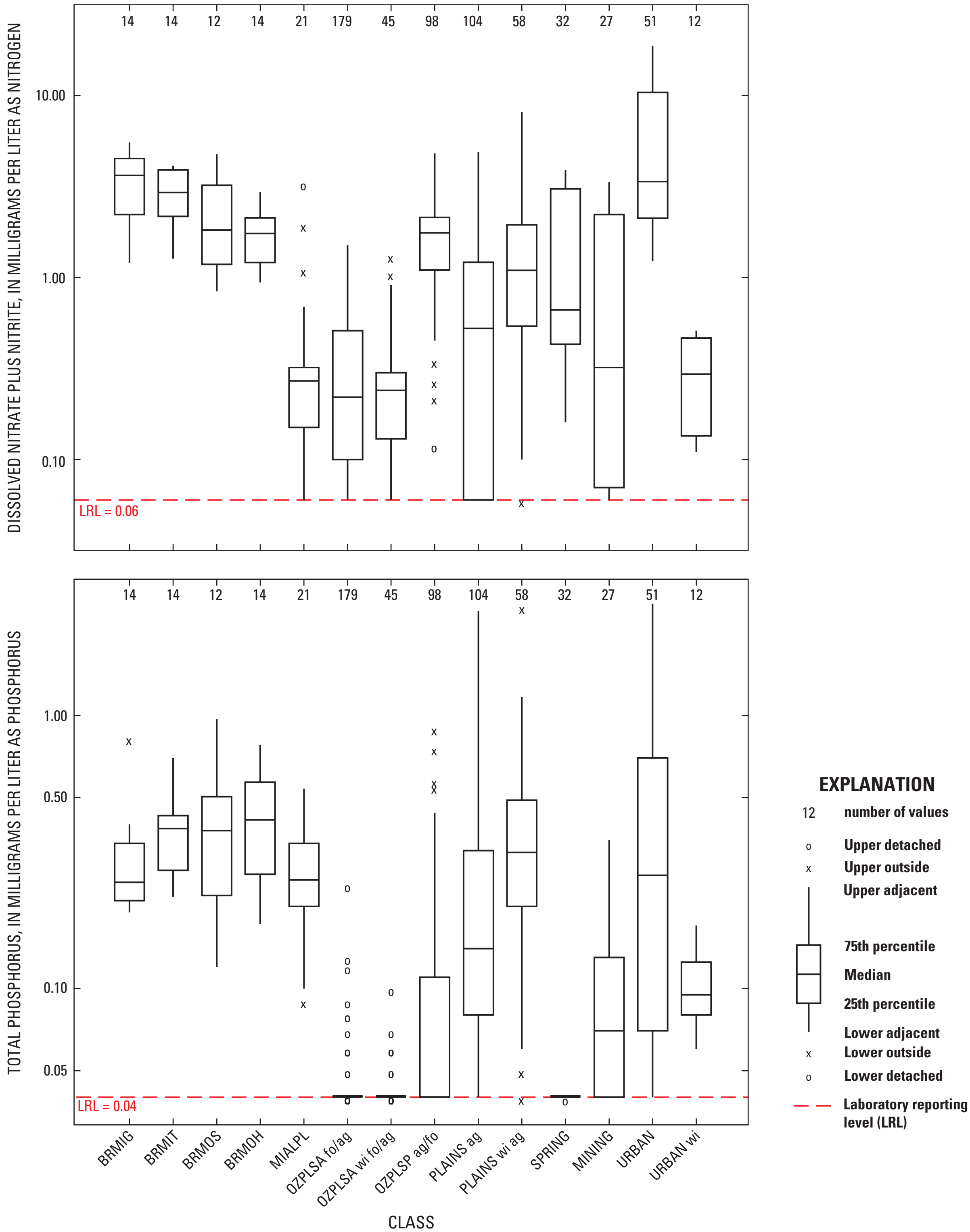

Figure 5. Concentration distribution of dissolved nitrate plus nitrite and total dissolved phosphorus in samples from 64 stations in the Ambient Water-Quality Monitoring Network (AWQMN), water year 2007.

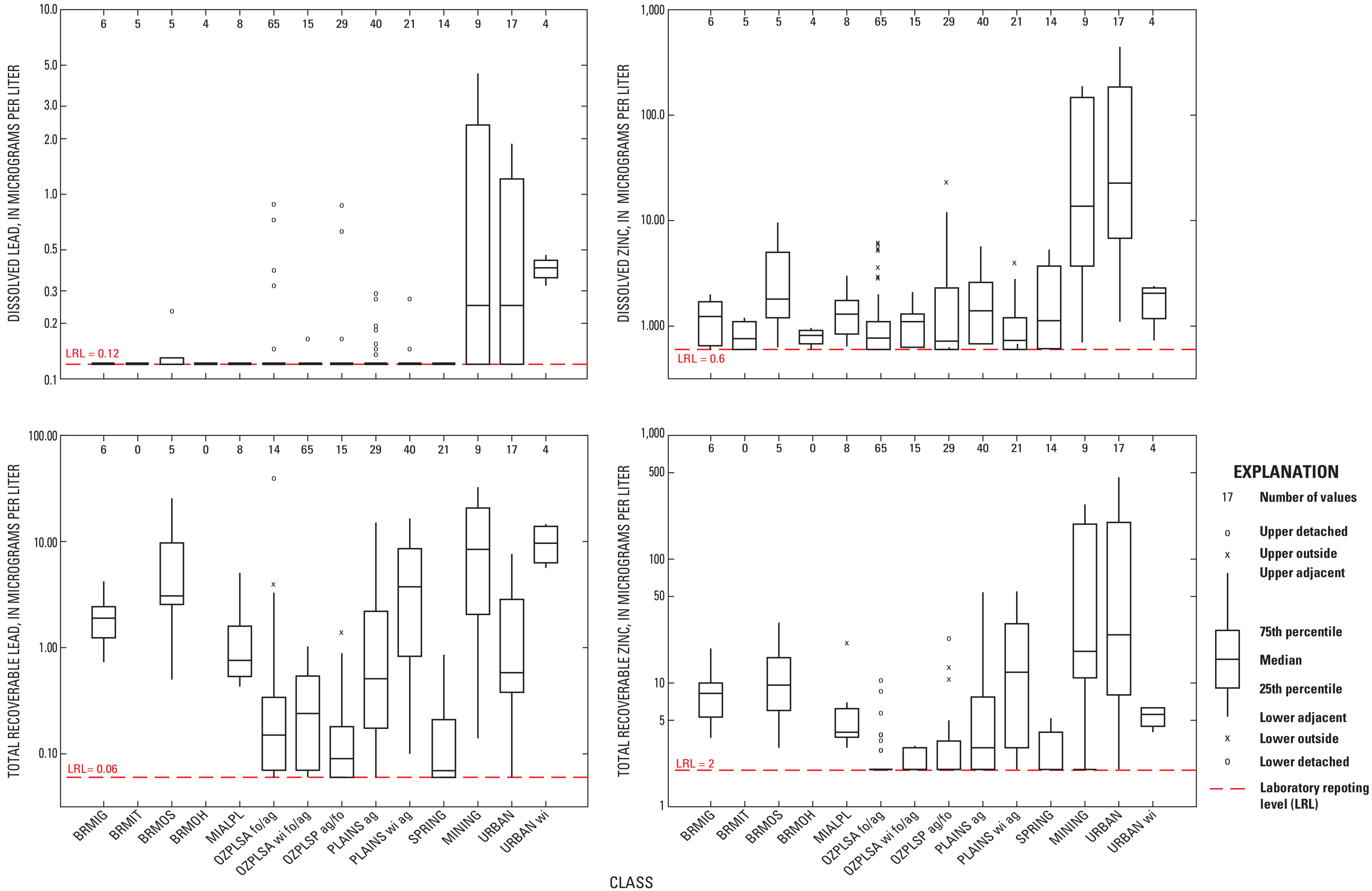

Figure 6. Concentration distribution of dissolved and total recoverable lead and zinc in samples from 64 stations in the Ambient Water-Quality Monitoring Network (AWQMN), water year 2007.

having the largest median values) and URBAN stations; followed by OZPLSP ag/fo and PLAINS wi ag; with the smallest being found at MIALPL, OZPLSA fo/ag, OZPLSA wi fo/ag, MINING, and URBAN wi stations. Similarly, median total phosphorus concentrations also are among the largest at the Big River (BRMIG having the smallest median value of the Big River stations) and URBAN stations, but in addition, samples collected at PLAINS wi ag stations also had larger median concentrations than other station types (fig. 5).

Distribution and Concentration of Dissolved and Total Recoverable Lead and Zinc

Filtered and unfiltered samples were collected for the analysis of dissolved and total recoverable trace elements, including lead and zinc. No total recoverable lead and zinc samples were collected at BRMIT and BRMIOH. Median concentration ranges of dissolved and total recoverable lead and zinc were as follows: dissolved lead, <0.12 to 0.40 micrograms per liter (μg/L); total recoverable lead, 0.07 to 10 μg/L; dissolved zinc, 0.72 to 23 μg/L; and total recoverable zinc <2 to 24 μg/L (fig. 6). The largest median concentrations for all four constituents generally were found in samples collected at MINING, URBAN, and URBAN wi stations. In addition, median total recoverable lead and zinc concentrations also were among the largest at PLAINS wi ag stations. The smallest median concentrations of dissolved and total recoverable lead and zinc generally were found in samples collected at all OZPL (SA fo/ag, SA wi fo/ag, and SP ag/fo) and SPRING stations (fig. 6).

Distribution, Concentration, and Detection Frequency of Selected Pesticides from Selected Stations

Filtered samples for the analysis of pesticides were collected at seven stations in the AWQMN, including three of the four Big River stations (BRMIG, BRMIT, and BRMOH), both stations in the MIALPL, one station in the PLAINS wi ag, and one SPRING station (fig. 7). The nine compounds that were detected are discussed here. None of the nine pesticides were detected at the SPRING station. The most frequently detected pesticides were atrazine and metolachlor, followed closely by CIAT (a transformation product of atrazine), acetachlor, and simazine. Pesticide concentrations generally were near or less than 1.00 μg/L. Notable exceptions are atrazine with concentrations ranging from <0.007 to 20.4 μg/L and metolachlor with concentrations ranging from <0.01 to 5.39 μg/L.

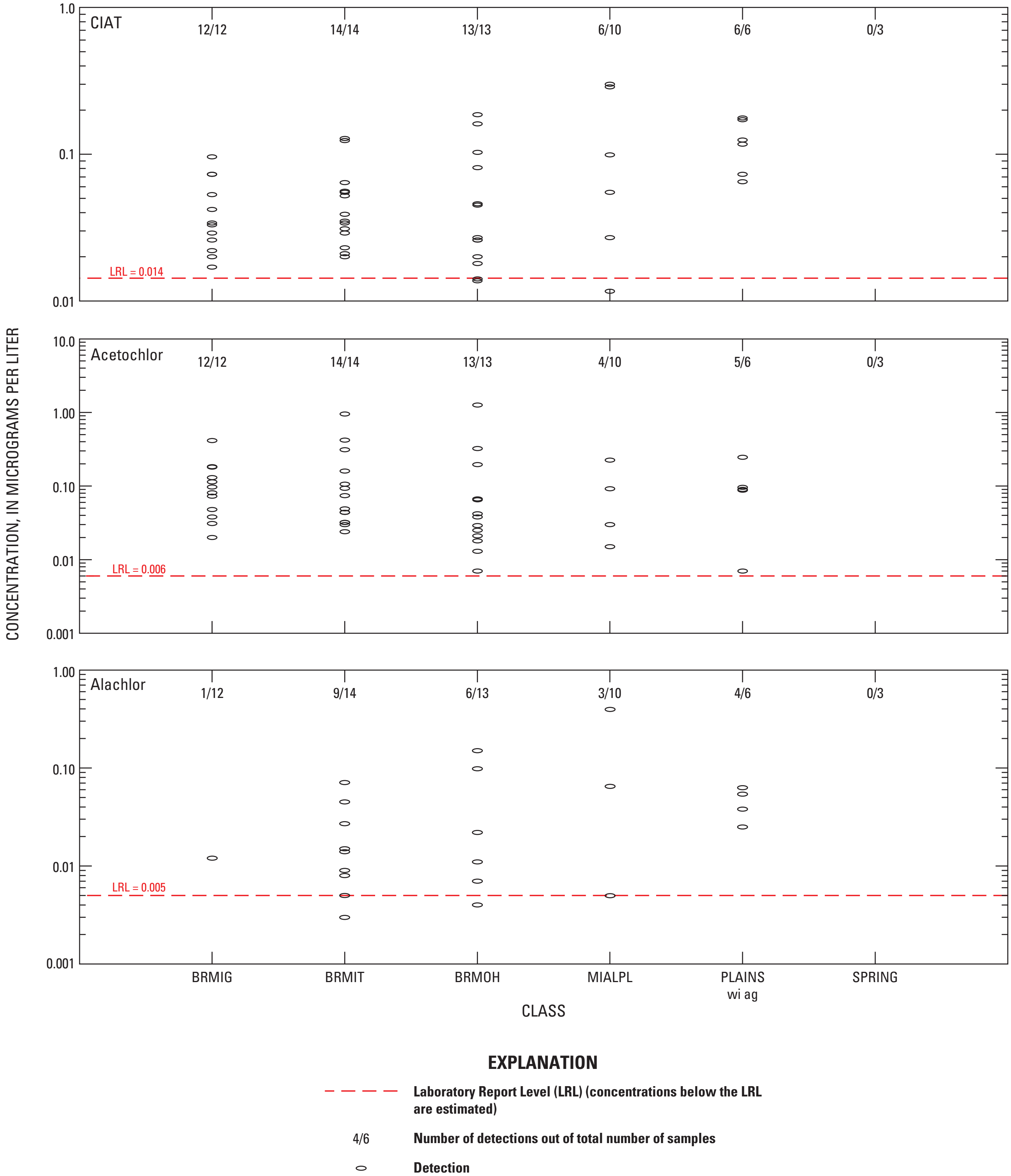

Figure 7. Distribution and detection of selected pesticides from selected stations in the Ambient Quality Monitoring Network (AWQMN), water year 2007.

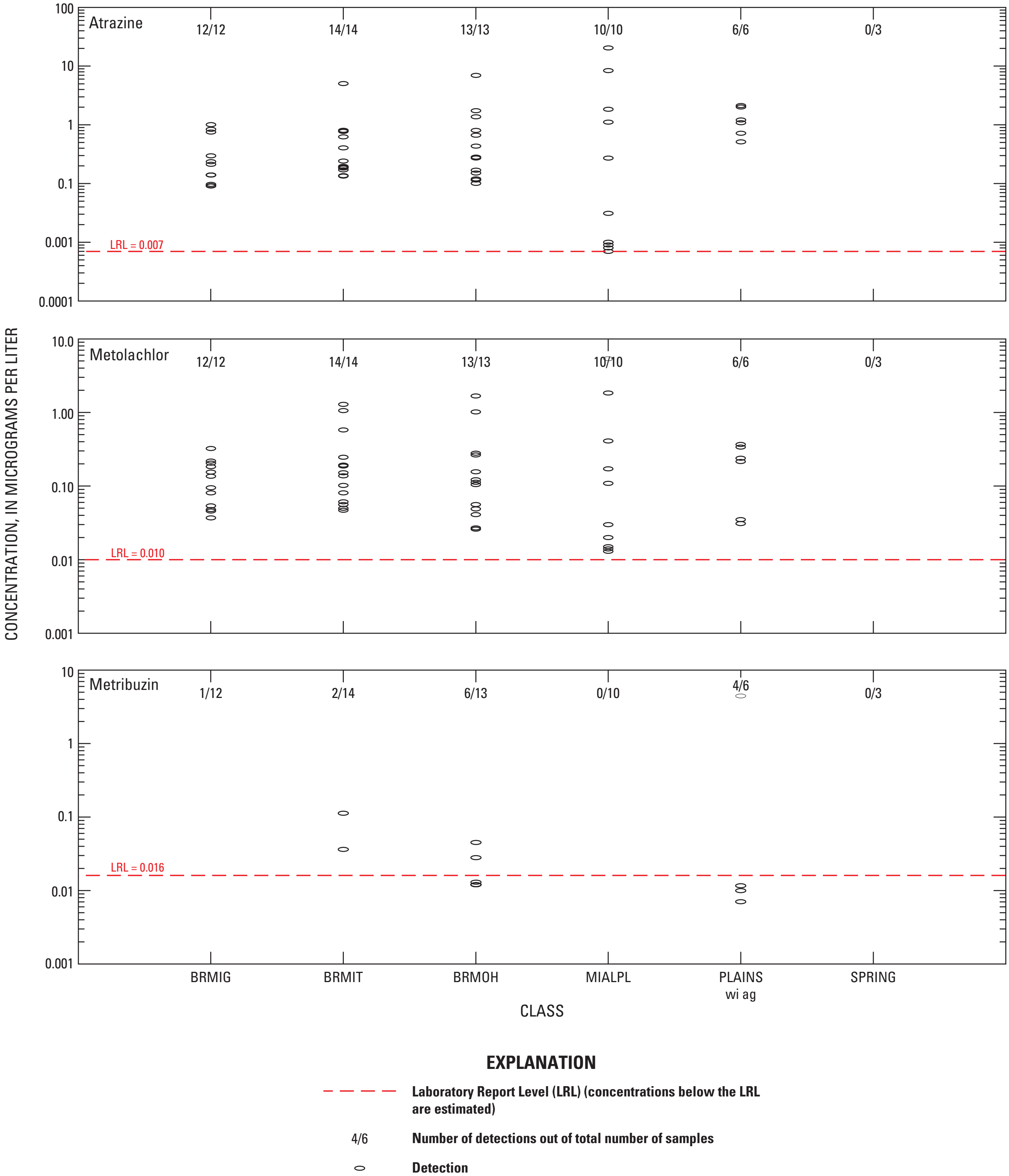

Figure 7. Distribution and detection of selected pesticides from selected stations in the Ambient Quality Monitoring Network (AWQMN), water year 2007.—Continued

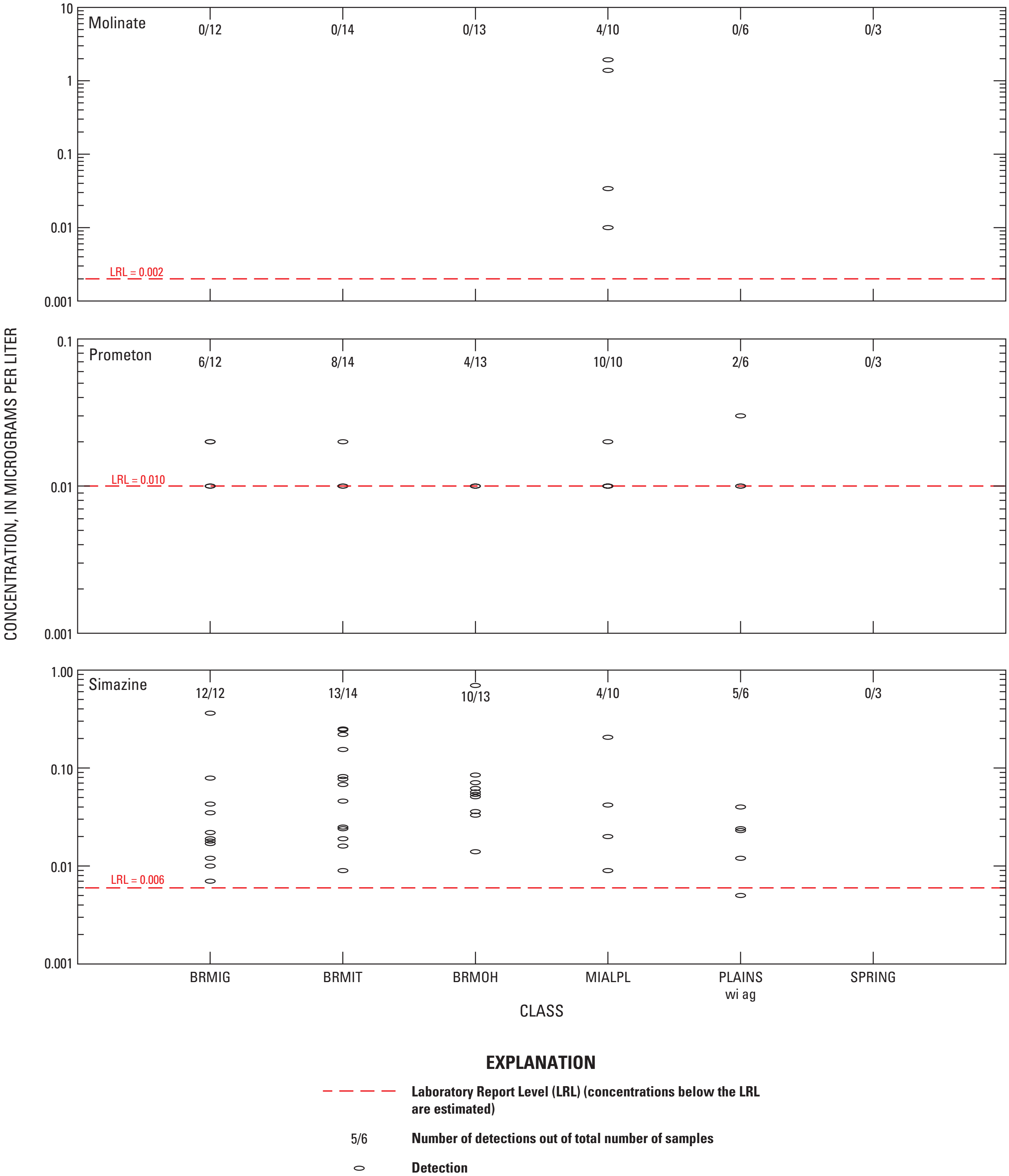

Figure 7. Distribution and detection of selected pesticides from selected stations in the Ambient Quality Monitoring Network (AWQMN), water year 2007.—Continued

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